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AUTHOR Thomas, John W.
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ABSTRACT

The Far West Laboratory used a five-step instructional systems design (ISD) model to develop a nationwide training and educational curriculum and delivery system for the Federal Emergency Management Agency. Stages of the model involved defining a comprehensive set of objectives, defining a priority curriculum, assigning training strategies, designing a training and delivery system, and developing a long-range use and development plan. In the absence of empirical data, four decision-making aids were built into the model to facilitate recycling (a characteristic of the ISD process that refers to techniques for reassessment based on feedback from the data collection, logical insight, and a review of consistency between design stages) and the validation of initial formulations: (1) an "input-transformation-output" configuration for each design stage, (2) cycles of divergence to convergence within each substep in each stage, (3) the use of "options profiles" and "configurations profiles," and (4) inventories composed of decision principles for making selection and matching choices in initial stages. These four devices provided logical rather than empirical procedures to help ensure that design decisions remained tied to the data and informed by a comprehensive view of constraints and possibilities. (YLB)

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APPLICATION OF A MODEL FOR IMPROVING THE TRAINING AND EDUCATION SYSTEM OF A FEDERAL AGENCY

John W. Thomas
Far West Laboratory for Educational
Research and Development

Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, April 15, 1983

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APPLICATION OF A MODEL FOR IMPROVING THE TRAINING AND EDUCATION SYSTEM OF A FEDERAL AGENCY

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The use of data to guide instructional design decisions is one of the primary ingredients of instructional systems design (ISD) models. Design proceeds in a series of iterative steps interspersed by data collection and verification activities that provide continuous assessment of the appropriateness of key decisions. But, when the task is to design large entities such as curricula and training systems rather than individual courses and products, existing techniques for assessment and verification are of limited value, especially when access to data sources is limited.

The paper presents a model that was used to guide the initial steps of the ISD process applied to the design of a complex, nationwide training and education curriculum and delivery system for the Federal Emergency Management Agency. Four devices for making design decisions in the absence of empirical data are described: (1) "input-transformation-output" configuration for each design stage; (2) cycles of divergence to convergence within each substep in each stage; (3) options and configurations profiles; and (4) inventories composed of decision principles for making selection and matching choices in initial stages. These four devices are offered as logical procedures that help to insure that design decisions remain tied to the data and informed by a comprehensive view of constraints and possibilities.

APPLICATION OF A MODEL FOR IMPROVING THE TRAINING AND EDUCATION SYSTEM OF A FEDERAL AGENCY

The "systems approach" in general and the "instructional systems design" (ISD) process in particular occupy a central if not preeminent role in the literature on instructional design. The ISD process has come to be identified with designing instruction based on data from the field (Branson, 1975), the planned articulation of instructional components such as objectives, teaching strategies, and testing methods (Briggs & Wager, 1981), and a consideration of both internal and external conditions that give rise to learning (Gagne & Briggs, 1974). To borrow from Gagne and Briggs' analysis, instructional systems design is an improvement over traditional instructional planning in that systematic thinking is combined with both theory, data, and "recycling" to yield, according to Hannum and Briggs (1982), a "science of instruction".

It is this recycling feature of the ISD process that is the focus of this paper. Recycling refers to both the iterative nature of the steps of the ISD process and to the techniques for reassessment built into the steps and substeps. The design process proceeds in cycles with feedback and "feedforward" occurring between the steps (Briggs & Wager, 1981; Gagne & Briggs, 1974). In most ISD applications, recycling takes the form of feedback from data collection: needs analyses, job analyses, pilot tests, expert reviews, etc. For example, a set of objectives that has been compiled through the use of surveys or job analyses might be validated with clients or users before beginning the next step of the process. Feedback from this substep might then be used to revise the objectives and to shape future materials development work.

But, recycling cannot always be empirical. There are at least three conditions or circumstances that necessitate a reliance on logic rather than data: (1) when you are in the initial analysis and design steps of the

ISD process (Stages 1-9 vs. 10-14 in Table 1); (2) when the ISD process is used to design large entities such as curricula, instructional systems, and schools; and (3) when, for one reason or another, your access to data sources is limited. Gagne and Briggs (1974) refer to the importance of recyclings based on "logical insight, review of consistency among all planning stages, and continued thinking about the system" (p. 213) in the early stages of the process; and Banathy (1973) refers to the role of product or solution models and to "conceptual testing" for handling complex design tasks. However, there remains a need to devise additional heuristics and specific procedures that will provide feedback and adjustment functions within the stages of the ISD process, especially when those stages involve selecting from among alternatives. This need can be demonstrated in the following design situation.

In 1981, the Far West Laboratory (FWL) was contracted by the Federal Emergency Management Agency (FEMA) to design a training and education system to serve its constituent audiences. FEMA was established in 1978 to consolidate all federal emergency-related programs and to create a single voice in the government for responding to state and local needs. Although there were components of a training and education capability in place at the time, they were considered to be vestiges of now-defunct member agencies. Moreover, the agency had been issued a new set of priorities by Congress, an Office of Training and Education had just been created, and there was widespread agreement within the office that there was a need for a systematic look at training and education goals and methods. Accordingly, FWL agreed to: (1) formulate a comprehensive set of emergency management training and education requirements (goals) for FEMA; (2) design a curriculum matched to training strategies that would fulfill these requirements; and (3) devise a plan for developing and institionalizing the training and education system (Thomas, 1982).

TABLE 1

STAGES IN INSTRUCTIONAL SYSTEMS DESIGN (Briggs, 1982)

- Stage 1: Analysis of needs, goals, and priorities.
- Stage 2: Analysis of resources and constraints.
- Stage 3: Selection of a delivery system.
- Stage 4: Preparation of a curriculum scope and sequence statement.
- Stage 5: Design of the organization of courses.
- Stage 6: Design of the organization of course units.
- Stage 7: Analysis of objectives.
- Stage 8: Organization of lessons.
- Stage 9: Designing the lessons.
- Stage 10: Assessment of learner performance.
- Stage 11: Development of materials.
- Stage 12: Empirical tryout and, if necessary, revision.
- Stage 13: Summative evaluation.
- Stage 14: Planning teacher preparation and diffusion.

With reference to Briggs' (1982) list of fourteen stages of instructional systems design displayed in Table 1, FWL's task was to complete steps 1-6. More specifically, FWL agreed to define the curriculum, which would consist of programmatic strands and courses matched to audiences, and to recommend training and delivery strategies for all FEMA courses and other educational initiatives. Although we defined each course according to a general goal and topic, we did not define objectives or design lessons.

The task proved to be complex and difficult. Not only was there a large set of standard design ingredients (needs, goals, priorities, resources, and constraints) and an even larger set of design features that had to be accommodated (4 system levels, 4 audience sectors, 34 audiences, and 4-8 functional agency divisions, etc.), there were a number of additional complicating factors. For example: (1) the agency had adopted about a 50% increase in training responsibilities over those of constituent agencies with no effective increase in training budget or staff; (2) there was no latitude in the contract for anything but a very cursory data-gathering and validation effort; and (3) although the majority of prior training-course offerings were instituted in order to prepare people to carry out emergency management roles, no job analyses and no data on audience or course effectiveness were available.

Figure 1 displays the scheme that was used by FWL staff to guide the project design task. A five-stage model was devised with Stages 1-4 corresponding roughly to Briggs' (1982) Stages 1-9 and with Stage 5 being a plan for accomplishing Briggs' Stages 10-14. Figure 1 provides a brief description of each substep within each stage as well as a listing of data sources. For present purposes, the remainder of the discussion will focus on some of the recycling features and decision-making aids built into the model.

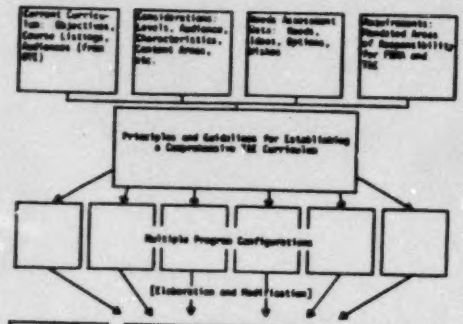
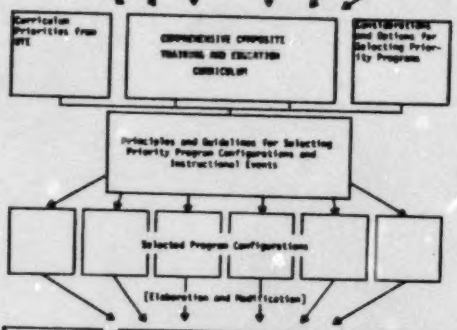
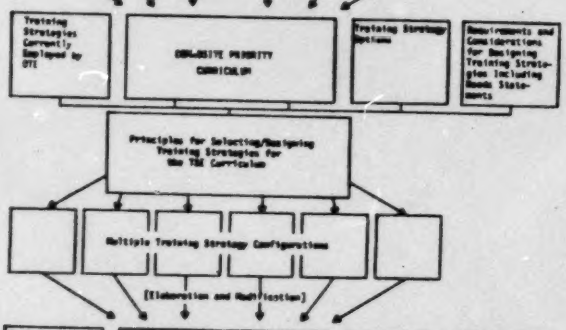
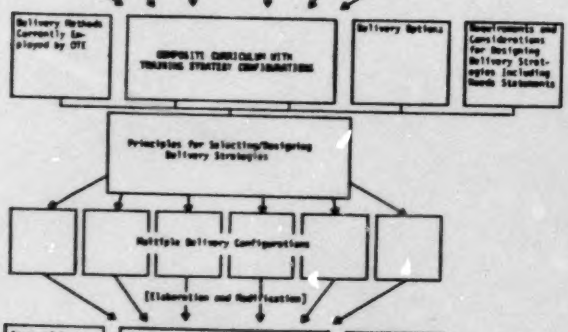
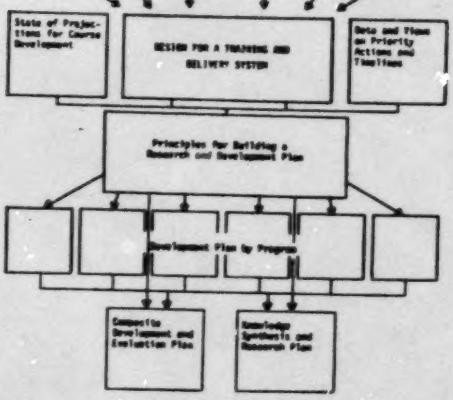
STAGES	PROCESS	DESCRIPTION	DATA SOURCES
Stage One: Defining a Comprehensive Set of Objectives		Information on requirements and data on needs	official mandates and authorities; needs statements from users; role analyses
		are filtered through principles and guidelines for curriculum expansion and for determining comprehensiveness:	goal and policy statements, internal memos, interviews
		new objectives and audiences are then arranged in functional configurations,	
Stage Two: Defining a Priority Curriculum		which are then compared to and incorporated into the existing curriculum.	questionnaires and interviews: administrative staff
		The composite curriculum along with data on priorities is filtered through principles and guidelines for selecting and defining programs and instructional events.	interviews
		Selected programs are then displayed with events by audience.	
Stage Three: Assigning Training Strategies		Data on existing and possible training formats	task/role analyses, cost analyses, practitioner interviews
		are filtered through principles for matching training strategies to types of instructional events;	models of media selection
		courses are then described by type of training strategy.	
Stage Four: Designing a Training and Delivery System		A composite implementation strategy is then described; data on delivery methods and options	practitioner interviews
		are then filtered through principles for defining optimum delivery strategies.	lessons from other training systems, delivery design models
		Delivery configurations are then assigned/designed and reconciled with existing methods.	
Stage Five: Developing a Long-Range Research and Development Plan		The final design is described; the design along with data on realia and priorities	budgets, projections, interviews with administrative staff
		are filtered through principles and criteria for plan development.	guidelines from other system design projects
		Development activities are then defined by audience and event by year.	
		Finally, a composite development plan and all ancillary activities are displayed.	additional complaints; needs collected through interviewing

Figure 1. A Five-Step Model for Guiding the Design of a Training and Education System for FEMA

The complexity involved in initial stages of the design combined with the lack of hard data to aid in decision making led to the incorporation of a number of modifications or elaborations of the ISD process. Four decision-making aids were built into the model in order to facilitate recycling and the validation of initial formulations.

(1) An "input-transformation-output" configuration for each stage. Stages were defined so that they would proceed from a definition of relevant input, to the definition and application of relevant principles for transforming the input, and finally to the development and display of a new product. Not only are the stages iterative in that all previous decisions are reviewed and revised during the transformation process, but each stage yields an independent design product that can be used to transform the work of previous stages and is the primary building block (input) for the subsequent stage.

For example, Figure 2 shows the process for Stage Four. Stage Four begins with the output from Stage Three which, in this case, is a "curriculum" (programmatic strands divided into individual course/audience topics with scope and sequence statements) that has been matched to appropriate instructional strategies (media and methods). Since the goal of Stage Four is to define delivery strategies for the courses that make up the curriculum, knowing what it is you want to deliver is not sufficient input. (Delivery refers to arrangements, responsibilities, timing considerations, and tactics for getting the course to the audience and institutionalizing its conduct.[1]) Additional types

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[1]FEMA provides training for a nationwide constituency of audiences, including the general public. Such training is currently provided through the voluntary cooperation of state and local emergency management offices using regional and state contracts, home-study materials, and limited federally-supervised training. The austerity of its resources, the lack of fixed facilities, and the "loosely-coupled" nature of the emergency management system makes the issue of who delivers instruction through what channel a major one.

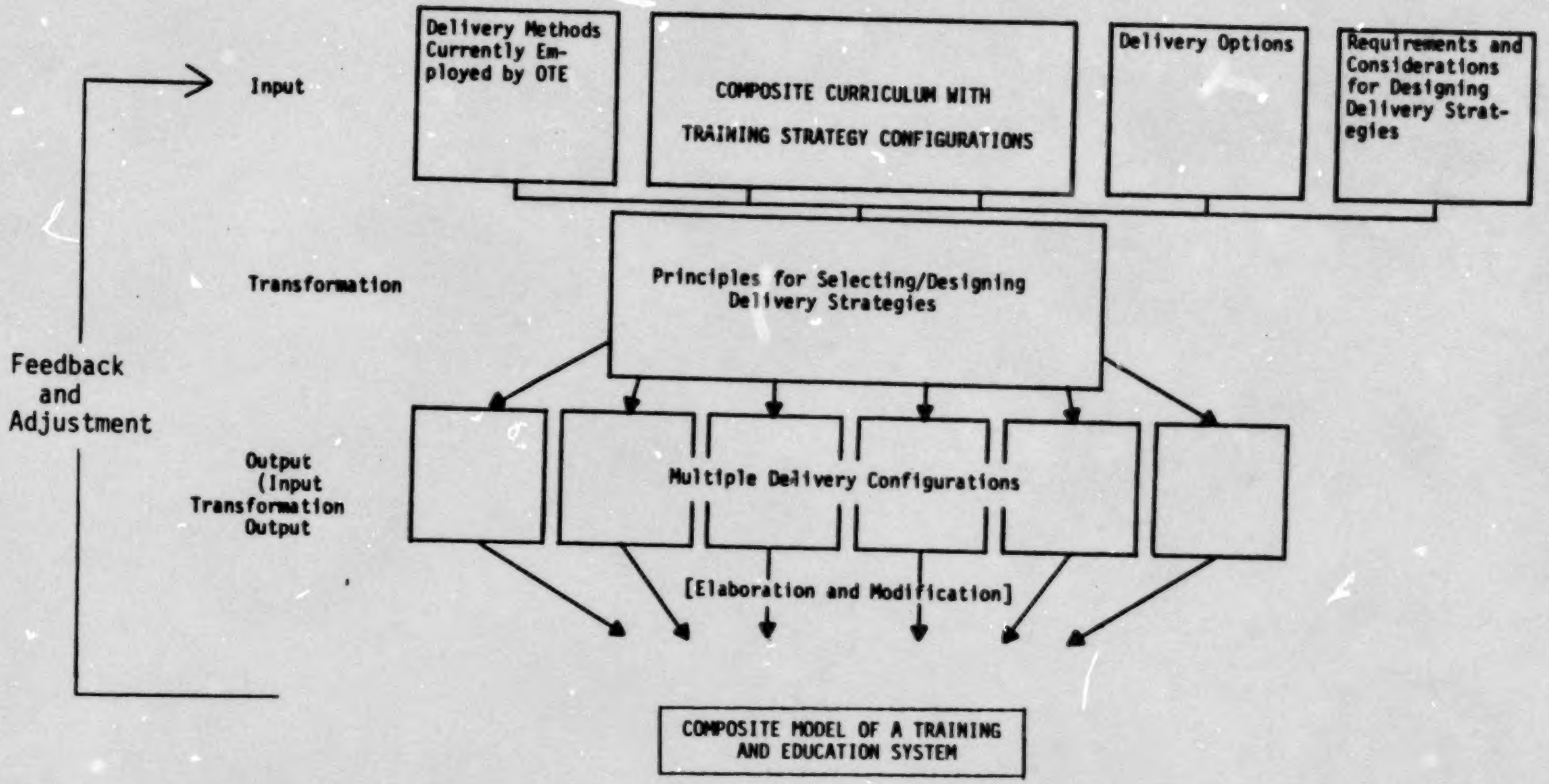
Input
Transformation
Feedback and Adjustment
Output (Input Transformation Output
Delivery Methods Currently Employed by OTE
COMPOSITE CURRICULUM WITH TRAINING STRATEGY CONFIGURATIONS
Delivery Options
Requirements and Considerations for Designing Delivery Strategies
Principles for Selecting/Designing Delivery Strategies
Multiple Delivery Configurations
[Elaboration and Modification]
COMPOSITE MODEL OF A TRAINING AND EDUCATION SYSTEM

Figure 2. Detail of Stage Four in the FWL Model with Input-Transformation Output Processes Identified

of input then might include general delivery options and requirements, constraints and possibilities specific to the "system" at large, and whatever data has bearing on the delivery issue. Once you have assembled and displayed all things to be considered, you need a way to use this input information to make decisions. In the present case, "principles" are defined from policy statements, client representatives, past experience of the agency, the general literature, etc. that can be used to make decisions about options, timing, and so on. In Stage Four, for example, principles help in the transformation of the output by guiding the selections, match-ups, and inventions that are necessary in order to define delivery strategies for the total curriculum.

Note that between the output of Stage Four ("Multiple Delivery Configurations") and the input for Stage Five, there is another step which in practice consists of prettying up the selections and match-ups and putting them in a form that can be understood by others. This step tends to involve a great deal of recycling in the form of corrections for consistency, elaborations, and refinements of ideas. Accordingly, it constitutes an additional input-transformation-output step that occurs within each stage.

(2) Cycles of divergence to convergence. A second feature of the model is that within each stage, all decision steps are preceeded by a step wherein judgment is deferred and all possibilities are considered. In consequence, each stage has an open-close-open-close structure to it that helps to insure that all things are considered as possible ideas. For example, before courses are matched to training strategies, the question is asked, "What are all the ways (methods, formats, media) that education and training events can occur?". Often this process results in ideas, borrowed from other training systems, that affect other stages of the design process.

(3) The use of "options profiles" and "considerations profiles". One of the primary reasons for validating interim design products is to check their adequacy and completeness before proceeding to the next stage in the design task. When clients, users, or data are not available to you for this purpose, or even when they are, it is useful to construct profiles--categorized lists supplemented by brief analyses--that detail the following issues: (a) what are all the things that I must consider, accommodate, surmount, and work out in my design; and (b) what are all the strategy options for each requirement that this design must address.

Table 2 presents a profile of considerations and Table 3 presents a profile of options for Stage Four, the selection and assignment of delivery strategies for the FEMA curriculum. Note that most of the items on these lists were considered and described separately. Descriptions of both "options" and "considerations" focus on "what does this imply for the design," which often results in revisions of completed design products (feedback) and the generation of new ideas for yet-to-be-completed design tasks (feedforward).

(4) The use of principles for making decisions involving selecting and matching. Steps in the ISD process are primarily of three sorts: data or information collection steps, syntheses steps wherein something new is formed, and decision making steps. The most frequent, or perhaps problematic, decision-making tasks are those involving: (a) selection from among options that appear to be of equal valence according to initial criteria, and (b) matching strategies such as media, training methods, or delivery strategies to selected content-course options. According to the model displayed in Figure 1, decision-making is seen to occur between data collection/analysis steps and synthesis/display steps, but, in reality, all three processes--analysis, decision-making, and synthesis--are involved in all steps of all stages.

TABLE 2

A CONSIDERATIONS PROFILE FOR SELECTING/ASSIGNING
TRAINING DELIVERY STRATEGIES

CONSIDERATIONS

Levels

System Level	Primary Actor	Role
Institutional	Governing Body	Sets policy, releases funds, provides guidelines monitors training
Management	Manager/Administrator	Interprets policies, establishes procedures, coordinates resources, manages training staff
(Operational)	(Trainer/Instructor)	(Trains trainers)
Instructional	Instructor	Plans and/or carries out instruction
Learning	Trainee	Participates in learning experience
(Technical)	(Volunteer/Selectee)	(Carries out duties as assigned by trained EM person)

Possible Stages

Research
Development
Diffusion
Implementation/Adoption
Institutionalization

Characteristics of Effective Delivery

- Adequate Design, Planning, and Evaluation
- Manageable Scope
- Timely Implementation
- Effective Leadership
- Appropriate Staff Characteristics

Dilemmas

- Standardization vs. Tailoring
- Centralized Control vs. Local Control
- Retention of existing channels vs. innovation
- Strive for narrow range of strategies vs. encourage variety of strategies

Possible Operational Requirements

Initiation Requirements

Establishing Awareness and Motivation
Establishing a Planning Capability
Orienting/training Trainers and Administrators
Securing and Organizing Resources and Support
Recruiting and Selecting Trainees
Adapting the Training System/Materials to Local Needs

Implementation Requirements

Conducting Training
Monitoring Training
Evaluating Training

Maintenance Requirements

Revising Training
Diffusing and Expanding Training
Providing Refresher Training
Compensatory for Attrition

TABLE 3

AN OPTIONS PROFILE FOR SELECTING/ASSIGNING
TRAINING DELIVERY STRATEGIES

OPTIONS

Delivery Agencies (Who)

- FEMA
  - Program Staff (HQ, regions)
  - T&E Staff (HQ, regions)
  - EMI Staff
  - Contract Staff
- State/County/Municipal Agencies
  - Staff
  - Contract Staff, consultants
- Other Federal Agencies
- Private Volunteer Agencies (see National Red Cross)
- Private Sector
  - Professional Associations
  - Businesses
  - Unions
- Educational Institutions
- Research & Development Institutions
- Community Agencies
- Consortium of Agencies

Development Strategies (When)

- In a crisis situation only
- On a regular calendar basis, e.g.,
  - Yearly
  - Bi-annually
- On request by
  - Trainees
  - FEMA program offices
  - States
- Linked to some scheduled initiative or program
- Administered to new hires and replacements

Methods of Arranging for Delivery (How)

- FEMA directs the administration
- FEMA contracts for delivery
- Trainees assume responsibility
- Formal cooperative agreement
- Informal agreement

Delivery Locations (Where)

- EMI
- Other FEMA Offices
- Colleges/Universities
- Training facilities of other agencies and organizations
- Miscellaneous facilities (hotels, conference centers, military facilities)
- Public schools
- Private homes

Types of Delivery Events (What)

- Dissemination (distribution of materials or messages)
- Conducting an Orientation Session
- Conducting a Mini-Course (seminar, workshop, conference)
- Administering a Training Course
- Administering a Program (a series of courses)

In practice, it is the decision-making step that is most problematic in design. One can list and define, with confidence, all the considerations and options related to, for example, the questions of how to teach what you have decided should be taught. But, when it comes time to select among training strategy options and to match options to content and audiences (not to mention, inventing strategies to fit circumstances), it helps to know what you're doing; which is to say it helps to have some principles and guidelines. Quite a number of these principles and guidelines can be found in "how-to" books on instructional systems development (e.g., Briggs & Wager, 1981; Merrill & Goodman, 1972). But, extant principles and techniques do not cover all of the decisions that have to be made in the ISD process, especially when the process involves the design of a curriculum with its associated selection decisions.

Table 4 presents a set of principles used by FWL staff to complete Stage Four of the design project. Table 5 displays a questionnaire that was constructed in order to operationalize some of these principles. Each course offering was examined separately using this questionnaire, and delivery options were selected according to the outcome.

Conclusion

The four design devices described above provide logical rather than empirical procedures to help insure that design steps and decisions remain on track. The more recycling decisions that occur early on in design work, the more likely that later empirical methods of enlisting feedback will result in minimal revisions to the design. The four devices presented above are not intended to be substitutes for needs analyses and expert or client review. However, they proved to be valuable when such analyses and review were not possible.

TABLE 4

PRINCIPLES FOR MATCHING DELIVERY STRATEGIES
TO COURSES AND PROGRAMS

PRINCIPLES

- There must be a compatibility of goals between a candidate delivery agency and FEMA's goals
- If possible, individuals should be trained by those who are directly responsible for the operational area involved and its policies
- Training should be provided within a realistic context
- Professionalism should be encouraged
  - --Courses given within a programmatic context
  - --Courses offered at Federal and State level facilities
  - --Credibility of materials, resources, instructors should be enhanced
- Agencies and organizations with emergency management or hazard reduction responsibilities should be enlisted to share delivery responsibilities
- Ideal delivery agencies are those that are innovative, open, and autonomous, while at the same time being stable, centralized, influential, and highly credible in the area of emergency management
- The most cost-effective and commitment-intensive delivery strategy is the multiplier strategy whereby stakeholders become responsible for aspects of delivery and for spreading delivery responsibilities to others within their own agency and outward to other agencies
- Formalized arrangements tend to be more effective for delivery than nonformal arrangements
- Redundancy of operations is a positive feature of a delivery system

TABLE 5

A SCHEME FOR DETERMINING DELIVERY REQUIREMENTS
AND DELIVERY AGENCIES/VEHICLES

1. Practical Considerations Affecting Delivery

   a. Demographic considerations:

      Number of trainees _____

      Number of trainee locations _____

      Nature of locations _____

   b. Priority of training area (for FEMA).

      ☐ High ☐ Medium ☐ Low

   c. Priority of training area (for trainees).

      ☐ High ☐ Medium ☐ Low

   d. Level at which training is focused.

      ☐ Federal ☐ State

      ☐ Regional ☐ Local

2. Other Considerations Affecting Delivery

   a. ☐ Necessity to provide for local tailoring.

   b. ☐ Necessity to provide for credibility or motivation.

   c. ☐ Necessity to provide special expertise as part of the event.

      _____

   d. ☐ Necessity to provide a particular kind of facility or resource.

      _____

   e. ☐ Other considerations:

      _____

      _____

      _____

   f. ☐ Presence of another institution, agency, or organization with compatible goals, requisite capabilities, and interest in providing training, facilities, or manpower.

      Agency _____

      Type of resource _____

TABLE 5 (Continued)

3. Relevant Principles

a. ☐ There must be a compatibility of goals between a candidate delivery agency and the goals of the requirement/event.

b. ☐ If possible, individuals should be trained by those who are directly responsible for the operational area, policies, supervising the trainee.

c. ☐ For the most important courses, professionalism should be encouraged through:

- ☐ the formation of career development programs
- ☐ the use of regional or federal facilities
- ☐ the enhancement of credibility through resources and high status, expert personnel

d. ☐ Agencies or organizations with emergency management or hazard reduction responsibilities should be enlisted to share delivery responsibilities.

- ☐ as instructors
- ☐ as coordinators
- ☐ provide facilities
- ☐ provide other services_____

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